

## ATTACHMENT

Sections 1-24 respond to arguments presented in the Final Office Action mailed December 12, 2005 in U.S. Serial No. 09/110,694. Sections 1-24 are presented since some of the arguments presented in Sections 25-118 refer to arguments presented in Sections 1-24.

### Section 1

With respect to the specific arguments advanced in the Action, the Committee begins by incorrectly asserting on page 4 that:

As stated in the previous office actions, applicant's claimed invention is based on the existence of the hydrino atom which is contrary to the known laws and theories of chemistry and physics.

That statement is simply untrue and the Committee cannot cite to any known law of chemistry or physics that has been violated. That is because there are none—Applicant's invention is based on compliance with all physical laws, even at the atomic level. Rather than using postulated unverifiable theories that treat atomic particles as if they were not real, Applicant now applies physical laws to atoms and ions. The Committee's failure to comprehend this fact is fatal to its entire analysis.

In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of  $e^-$  moving in the Coulombic field of the proton with a true wave equation, as opposed to the diffusion equation of Schrödinger, a classical approach is explored that yields a remarkably accurate model and provides insight into physics on the atomic level. The proverbial view deeply seated in the wave-particle duality notion that there is no large-scale physical counterpart to the nature of the electron is shown to be incorrect. Physical laws and intuition may now be restored when dealing with the wave equation and quantum atomic problems.

Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles as reported previously [1-7] that successfully applies physical

laws to the solution of atomic problems that has its basis in a breakthrough in the understanding of the stability of the bound electron to radiation. Rather than using the postulated Schrödinger boundary condition: " $\Psi \rightarrow 0$  as  $r \rightarrow \infty$ ", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound  $n = 1$ -state electron cannot radiate energy*. Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally, wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. The solution of the excited states of one-electron atoms is given in R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, January 2005 Edition, BlackLight Power, Inc., Cranbury, New Jersey, (" '05 Mills GUT"):

Classical Quantum Theory of the Atom Based on Maxwell's Equations

The old view that the electron is a zero or one-dimensional point in an all-space probability wave function  $\Psi(x)$  is not taken for granted. The theory of classical quantum mechanics (CQM), derived from first principles, must successfully and consistently apply physical laws on all scales [1-7]. Stability to radiation was ignored by all past atomic models. Historically, the point at which QM broke with classical laws can be traced to the issue of nonradiation of the one electron atom. Bohr just postulated orbits stable to radiation with the further postulate that the bound electron of the hydrogen atom does not obey Maxwell's equations—rather it obeys different physics [1-10]. Later physics was replaced by "pure mathematics" based on the notion of the inexplicable wave-particle duality nature of electrons which lead to the Schrödinger equation wherein the consequences of radiation predicted by Maxwell's equations were ignored. Ironically, Bohr, Schrödinger, and Dirac used the Coulomb potential, and Dirac used the vector potential of Maxwell's equations. But, all ignored electrodynamics and the

corresponding radiative consequences. Dirac originally attempted to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gave rise to electron spin [11]. He and many founders of QM such as Sommerfeld, Bohm, and Weinstein wrongly pursued a planetary model, were unsuccessful, and resorted to the current mathematical-probability-wave model that has many problems [10, 11-14]. Consequently, Feynman for example, attempted to use first principles including Maxwell's equations to discover new physics to replace quantum mechanics [15].

Physical laws may indeed be the root of the observations thought to be "purely quantum mechanical", and it was a mistake to make the assumption that Maxwell's electrodynamic equations must be rejected at the atomic level. Thus, in the present approach, the classical wave equation is solved with the constraint that a bound  $n = 1$ -state electron cannot radiate energy.

Herein, derivations consider the electrodynamic effects of moving charges as well as the Coulomb potential, and the search is for a solution representative of the electron wherein there is acceleration of charge motion without radiation. The mathematical formulation for zero radiation based on Maxwell's equations follows from a derivation by Haus [16]. The function that describes the motion of the electron must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light. Similarly, nonradiation is demonstrated based on the electron's electromagnetic fields and the Poynting power vector.

It was shown previously [1-7] that CQM gives closed form solutions for the atom including the stability of the  $n = 1$  state and the instability of the excited states, the equation of the photon and electron in excited states, the equation of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum,  $\mathbf{r} \times \mathbf{p}$ , can be applied directly to the wave function (a current density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, g factor, Lamb shift, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies, and momenta, orbital and spin splitting, spin-

orbital coupling, Knight shift, and spin-nuclear coupling, and elastic electron scattering from helium atoms, are derived in closed-form equations based on Maxwell's equations. The calculations agree with experimental observations.

The Schrödinger equation gives a vague and fluid model of the electron. Schrödinger interpreted  $e\Psi^*(x)\Psi(x)$  as the charge-density or the amount of charge between  $x$  and  $x+dx$  ( $\Psi^*$  is the complex conjugate of  $\Psi$ ). Presumably, then, he pictured the electron to be spread over large regions of space. After Schrödinger's interpretation, Max Born, who was working with scattering theory, found that this interpretation led to inconsistencies, and he replaced the Schrödinger interpretation with the probability of finding the electron between  $x$  and  $x+dx$  as

$$\int \Psi(x)\Psi^*(x)dx \quad (1)$$

Born's interpretation is generally accepted. Nonetheless, interpretation of the wave function is a never-ending source of confusion and conflict. Many scientists have solved this problem by conveniently adopting the Schrödinger interpretation for some problems and the Born interpretation for others. This duality allows the electron to be everywhere at one time—yet have no volume. Alternatively, the electron can be viewed as a discrete particle that moves here and there (from  $r=0$  to  $r=\infty$ ), and  $\Psi\Psi^*$  gives the time average of this motion.

In contrast to the failure of the Bohr theory and the nonphysical, adjustable-parameter approach of quantum mechanics, multielectron atoms [1, 5] and the nature of the chemical bond [1, 4] are given by exact closed-form solutions containing fundamental constants only. Using the nonradiative wave equation solutions that describe the bound electron having conserved momentum and energy, the radii are determined from the force balance of the electric, magnetic, and centrifugal forces that corresponds to the minimum of energy of the system. The ionization energies are then given by the electric and magnetic energies at these radii. The spreadsheets to calculate the energies from exact solutions of one through twenty-electron atoms are given in '05 Mills GUT [1] and are available from the internet [17]. For 400 atoms and ions the agreement between the predicted and experimental results is remarkable.

### References<sup>1</sup>

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, January 2005 Edition; posted at <http://www.blacklightpower.com/bookdownload.shtml>.
2. R. L. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.
3. R. L. Mills, "Classical Quantum Mechanics", submitted; posted at <http://www.blacklightpower.com/pdf/CQMTheoryPaperTablesand%20Figures080403.pdf>.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", submitted; posted at <http://www.blacklightpower.com/pdf/technical/H2PaperTableFiguresCaptions111303.pdf>.
5. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", submitted; posted at <http://www.blacklightpower.com/pdf/technical/Exact%20Classical%20Quantum%20Mechanical%20Solutions%20for%20One-%20Through%20Twenty-Electron%20Atoms%20042204.pdf>.
6. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", submitted; posted at <http://www.blacklightpower.com/pdf/technical/MaxwellianEquationsandQED080604.pdf>.
7. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted; posted at <http://www.blacklightpower.com/pdf/technical/ExactCQMSolutionforAtomicHelium073004.pdf>.
8. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", submitted; posted at <http://www.blacklightpower.com/pdf/Feynman%27s%20Argument%20Spec%20UPDATE%20091003.pdf>.
9. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.
10. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
11. P. Pearle, *Foundations of Physics*, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

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<sup>1</sup> The references cited here, and in other passages of Mills' papers quoted throughout this Response, should not be confused with the references cited on Applicant's master list.

12. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
13. H. Wergeland, "The Klein Paradox Revisited", *Old and New Questions in Physics, Cosmology, Philosophy, and Theoretical Biology*, A. van der Merwe, Editor, Plenum Press, New York, (1983), pp. 503-515.
14. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
15. F. Dyson, "Feynman's proof of Maxwell equations", Am. J. Phys., Vol. 58, (1990), pp. 209-211.
16. H. A. Haus, "On the radiation from point charges", American Journal of Physics, Vol. 54, 1126-1129 (1986).
17. <http://www.blacklightpower.com/new.shtml>.

The hydrogen atom is solved correctly using classical quantum mechanics. It provides for the stability of the hydrogen atom based on Maxwell's equations; whereas standard quantum mechanics (SQM) does not. Further application of physical laws predicts that energy can be transferred nonradiatively to a catalyst that can resonantly accept the energy to form lower-energy states of hydrogen corresponding to an extension of the Rydberg states to lower levels. These states are confirmed experimentally.

Studies that experimentally confirm a novel reaction of atomic hydrogen which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ( $n = 1$ ) state, a chemically generated or assisted plasma (rt-plasma), and produces novel hydride compounds are summarized above in the section entitled, "Lower-Energy Hydrogen Experimental Data" and include:

- extreme ultraviolet (EUV) spectroscopy<sup>2</sup>,
- characteristic emission from catalysis and the hydride ion products<sup>3</sup>,
- lower-energy hydrogen emission<sup>4</sup>,
- plasma formation<sup>5</sup>,
- Balmer  $\alpha$  line broadening<sup>6</sup>,

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<sup>2</sup> Ref. Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104, 108-109, 110-112. The complete list of reference Nos. is shown below.

<sup>3</sup> Ref. Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91, 108

<sup>4</sup> Ref. Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104, 110-112

<sup>5</sup> Ref. Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108-109

population inversion of hydrogen lines<sup>7</sup>,  
elevated electron temperature<sup>8</sup>,  
anomalous plasma afterglow duration<sup>9</sup>,  
power generation<sup>10</sup>,  
excessive light emission<sup>11</sup>, and  
analysis of chemical compounds<sup>12</sup>.

## **Section 2**

The Committee's faulty analysis of Applicant's novel hydrogen technology continues on page 4 of its Action with the argument that:

Applicant's theory of the hydrino atom predicts a new form of the hydrogen atom having energy states represented by fractional quantum numbers that are below the conventional ground state of the hydrogen atom. These energy states having fractional quantum numbers are contrary to the conventionally accepted energy states of the hydrogen atom having positive integer quantum numbers predicted by quantum mechanics that have been successfully verified by decades of independent, reproducible experimental results as stated in ATTACHMENT TO RESPONSE TO APPLICANT'S ARGUMENTS in paper #24 mailed on 7/5/2001 (hereinafter referred to as "ATTACHMENT in paper #24").

The Committee refuses to recognize that SQM has many problems that disqualifies it as providing the correct solution of the hydrogen atom in the nonradiative, stable  $n=1$  state, as well as excited states, as discussed previously in:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

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<sup>6</sup> Ref. Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105, 108-109, 114

<sup>7</sup> Ref. Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91

<sup>8</sup> Ref. Nos. 34-37, 43, 49, 63, 67, 73

<sup>9</sup> Ref. Nos. 12-13, 47, 81

<sup>10</sup> Ref. Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104, 108, 110-112

<sup>11</sup> Ref. Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72, 109

<sup>12</sup> Ref. Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104, 108, 110-112

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", *Annales de la Fondation Louis de Broglie*, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", *Physics Essays*, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", *Physics Essays*, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", *Annales de la Fondation Louis de Broglie*, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", *Physics Essays*, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at [www.blacklightpower.com](http://www.blacklightpower.com).

CQM correctly predicts not only the known stable  $n=1$  state and the excited-state energy levels of atomic hydrogen, including the conjugate observables such as the fine structure, Lamb shift, electron spin, the  $g$  factor, and the hyperfine structure missed entirely by the Schrodinger Equation (SE), but it also correctly predicts new energy states formed by a nonradiative, resonant energy transfer to a catalyst. These states are also missed entirely by the SE. This is no surprise since the SE is not predictive; it is not based on observable physics, and it is purely mathematical.

Once again, studies that experimentally confirm a novel reaction of atomic hydrogen which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ( $n = 1$ ) state, a chemically generated or assisted



plasma (rt-plasma), and produces novel hydride compounds are summarized in the document entitled, "Lower-Energy Hydrogen Experimental Data" and include:

- extreme ultraviolet (EUV) spectroscopy,<sup>13</sup>
- characteristic emission from catalysis and the hydride ion products,<sup>14</sup>
- lower-energy hydrogen emission,<sup>15</sup>
- plasma formation,<sup>16</sup>
- Balmer  $\alpha$  line broadening,<sup>17</sup>
- population inversion of hydrogen lines,<sup>18</sup>
- elevated electron temperature,<sup>19</sup>
- anomalous plasma afterglow duration,<sup>20</sup>
- power generation,<sup>21</sup>
- excessive light emission,<sup>22</sup> and
- analysis of chemical compounds.<sup>23</sup>

## **Section 2a**

The Committee further argues on page 4 of the Action that:

With respect to applicant's recent response, applicant mostly repeats his previous arguments which have been addressed by the Examiner as seen in all of the previous responses to applicant's arguments. Therefore, all of the Examiner's previous responses to applicant's arguments of record, and the appendixes included in all of the previous office actions to support the Examiner's arguments are incorporated by reference in their entirety into this present response to applicant's arguments. Since applicant's arguments on theoretical and experimental grounds are the same as those

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<sup>13</sup> Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104, 108-112.

<sup>14</sup> Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91, 108.

<sup>15</sup> Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104, 110-112.

<sup>16</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108, 109.

<sup>17</sup> Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105, 108, 109.

<sup>18</sup> Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91.

<sup>19</sup> Reference Nos. 34-37, 43, 49, 63, 67, 73.

<sup>20</sup> Reference Nos. 12-13, 47, 81.

<sup>21</sup> Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104, 108, 110-112.

<sup>22</sup> Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72, 109.

<sup>23</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104, 108, 110-112.

presented in copending case 09/009,837, the Appendix written by Examiner Bernard Souw for copending case 09/009,837 is also attached to this present office action.

It is simply not true that Applicant mostly repeats his previous arguments. To the contrary, Applicant has specifically and fully responded to each and every point raised by the Committee and submitted experimental evidence to further expose its erroneous positions. It is the Committee who has failed to fully respond to Applicant's rebuttal arguments and to fairly evaluate his evidence.

### **Section 3**

The Committee further argues on pages 4-5 of the Action that:

All of the Examiner's previous office actions and the present attached appendix by Examiner Bernard Souw explain over and over again why applicant's theory is mathematically and physically flawed. Applicant's flawed theory cannot predict the existence of the hydrino and conventional quantum mechanics forbids the theoretical existence of the hydrino. [Emphasis in original.]

Applicant has explained over and over again why SQM is not a valid theory and the Committee has in most cases failed to address, much less rebut, Applicant's position. The Committee continues to misstate that the Schrodinger equation (SE) is a law of nature. Laws are based on reality. That is, they are based on directly measurable parameters, such as energy, mass, electric fields, magnetic fields, forces, etc. The SE has as its parameter Psi, which has no physical basis in reality. This is discussed in detail in, F. Laloë, "Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems," Am. J. Phys. 69 (6), June 2001, 655-701, and has been pointed out in numerous papers by Applicant:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", Annales de la Fondation Louis de Broglie, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at [www.blacklightpower.com](http://www.blacklightpower.com).

The SE gives no stability to radiation and is not predictive of the conjugate parameters of the hydrogen atom. It does not even obey causality. This has been argued by even the founders of quantum mechanics, such as Schrodinger himself, de Broglie, Weisskopf, Einstein, and others as pointed out repetitively by Applicant. These essential points have been presented in responses to prior office actions, as well as in the papers cited above and citations therein. The Committee continues to refuse to face these inescapable realities of the failures and limitations of SQM. Even more disturbing is its refusal to engage Applicant on the overwhelming amount of data that directly confirms the existence of the disclosed new states of atomic hydrogen summarized in the section above entitled, "Lower-Energy Hydrogen Experimental Data".

Many postulated theories of physics have been weakened or disproven due to new real-world measurements. The observation of the acceleration of the expansion of the cosmos predicted by Applicant's theory years before it was confirmed experimentally undercuts the traditional "Big Bang" origin of the

universe. The observation from the Hubble images that time is continuous disproves string theories and the Heisenberg Uncertainty principle. The failure to find the Higgs boson undercuts the standard model as providing no basis for masses of fundamental particles; whereas Applicant accurately calculates the masses in closed form, including the mass of the top quark before it was detected at the D0 detector. Applicant's theory is based on physical laws and unifies Maxwell's equations with Special and General relativity and atomic physics. Other hodgepodge theories based on postulates and pure mathematics are proving to be failures. The Committee's failure to concede these well-known facts merely confirms its biases and the arbitrary approach it has taken to examining the present applications.

The data and the details of these results are given in the following papers and book:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", Annales de la Fondation Louis de Broglie, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at [www.blacklightpower.com](http://www.blacklightpower.com).

#### **Section 4**

Incredibly, after Applicant has already invested millions of dollars supplying the Committee with the published experimental evidence it required for patentability, the Committee now informs Applicant that his experimental evidence is of little or no value. On page 5 of its Action, the Committee argues that Applicant's real-world evidence of lower-energy hydrogen can be essentially ignored because it detracts from the fact that it does not theoretically exist:

It is also illogical for the applicant to analyze his own experimental data using his flawed hydrino theory to prove the existence of the hydrino atom as stated in the previous office actions. Since applicant's theory is scientifically and mathematically flawed, there is no theoretical foundation for the hydrino atom and all of applicant's data cannot prove what is not theoretically possible. All of applicant's own experimental evidence of record detract from the central issue that the hydrino does not theoretically exist.  
[Emphasis in original.]

The Committee has it completely backwards. Rather than the possibility that "lower-energy hydrogen does not theoretically exist", quantum mechanics does not physically exist. It is simply a mathematical postulate that can not be tested and has no basis in reality. Physical laws that predict, and experimental data that clearly confirms, the existence of lower-energy hydrogen do exist. Quantum mechanics provides no physical basis for any state of hydrogen. Particularly troublesome is that under SQM, the electron is not stable to radiation. This point is shown by Applicant's analysis [80. R. L. Mills, *The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics*, Annales de la Fondation Louis de Broglie, submitted], as well as by other theoreticians such as those at Princeton University who show that the Heisenberg Uncertainty Principle provides no atomic stability [E. H. Lieb,

"The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569].

Quantum mechanics is not even a theory, and its very premises are nonsensical. It is based on applying statistics to a single particle and a single event. This weird contrivance is then interpreted as meaning the electron can be everywhere at once with an infinite number of positions and energies simultaneously including those that go to infinity in the positive as well as **negative** directions. Even more problematic is that according to SQM the electron has no physical form until it is measured. Thus, according to the Committee's position, since it creates hydrogen, it can chose which states can exist in reality.

Furthermore, the success of SQM at reproducing numbers comes from the fact that it merely comprises internally inconsistent curve-fitting algorithms devoid of any physics. The ability of the founding equation, the Schrodinger equation (SE) and its solutions, to reproduce the Rydberg formula are touted as justifying the validity of quantum mechanics as representing the nature of physics on the atomic scale. This false confidence gives rise to the practice of curve fitting problems other than the principal energy levels of one electron atoms (the only problem for which a closed-form equation arises) with adjustable-parameters. However, when the postulated SE is evaluated at its fundamental level, it becomes readily apparent that the SE is merely a complicated equivalent form of the Rydberg formula, to which it reduces. The SE has no predictability, nor does it contain any physical truth. It misses stability to radiation, electron spin, the Lamb shift, fine structure, hyperfine structure, g factor and many other observables as detailed previously (see papers below). The lack of predictability confirms that the SE is just a mathematical statement of an empirical relationship discovered a generation prior to it being postulated, and it is not a real theory. See:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", Annales de la Fondation Louis de Broglie, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at [www.blacklightpower.com](http://www.blacklightpower.com).

Finally, Applicant must once again highlight the Committee's inconsistent positions in claiming that the existence of lower-energy hydrogen "is not theoretically possible." Ironically, when Applicant first criticized the Committee for taking that extreme position, its response was to chastise him for mischaracterizing its position, claiming it has never said that the existence of lower-energy hydrogen was "impossible." These inconsistent positions do little to provide Applicant with a fair and expeditious examination of his novel hydrogen technology. The time has come to stop this nonsense and fairly evaluate Applicant's technology so that his patents can once again be issued. Thus, while Applicant is certainly willing to debate the theoretical predictions of lower energy states of hydrogen, it is incumbent upon the Committee to follow proper patent standards and evaluate the real-world evidence confirming the existence of lower-energy hydrogen. To this day it has not done so.

## **Section 5**

The Committee, on pages 5-6 of the Action, misapprehends the implications of Applicant's evidence, in arguing that:

Applicant in his present response continues to misinterpret his own evidence of record and cited prior art. The applicant also continues to misinterpret the Examiner's statements. The discussion below and the attached appendix illustrate some of applicant's misinterpretations.

With respect to applicant's response on 12/21/2004 regarding his NMR data, the applicant modifies his own NMR evidence of record by submitting a new declaration by Dr. Turner signed on 8/24/2004. In the previous office action, the Examiner rebutted applicant's conclusion that the upfield shifts in his NMR data are due to the alleged novel hydrino compound by responding that contaminants such as  $\beta$ -MgNiH have the same upfield shifts. In the previous office action, the Examiner pointed out that Dr. Turner's original declaration filed on 5/18/2000 states that he has never observed shifts in the region of -4 to -5 ppm in his 20 years of practicing NMR spectroscopy since 1978 except in applicant's samples (a copy of the declaration was attached to the previous office action). Just because Turner himself never observed shifts in the region from -4 to -5 ppm does not provide positive evidence that these are due to novel compounds and not due to any previously known compounds. [Emphasis in original.]

As stated in Turner's declaration, the compound that showed the upfield shift only contains potassium as the cation, not magnesium and nickel. So, the Committee's argument that MgNiH has an upfield NMR shift is irrelevant. KH does not have an upfield shift. Nor does hydride substitution for chloride produce an upfield shift as detailed in the following articles:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.
111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species  $H^-(1/4)$  and  $H_2(1/4)$  as a New Power Source", Thermochemica Acta,



submitted.

110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).

## **Section 6**

According to the Committee, on pages 6-7 of its Action:

The Examiner rebutted this statement in Turner's original declaration by citing references to Hayashi (Hayashi, S. et al.

(1997) "Accurate determination of  $^1\text{H}$  Knight shifts in  $\text{Mg}_2\text{NiH}_x$  and  $\text{MgH}_x$  by means of high-speed magic angle spinning," *Journal of Alloys and Compounds*, vol. 248, pp. 66-69 (Paper A); Hayashi, S.

et al. (1997) " $^1\text{H}$  NMR and magnetization measurements of a nanostructured composite material of the  $\text{Mg}_2\text{Ni-H}$  system synthesized by reactive mechanical grinding," *Journal of Alloys and Compounds*, vol. 256, pp. 159-165 (Paper B); Hayashi, S. et al.

(1997) "Local structures and hydrogen dynamics in amorphous and nanostructured  $\text{Mg-Ni-H}$  systems as studied by  $^1\text{H}$  and  $^2\text{H}$  nuclear magnetic resonance," *Journal of Alloys and Compounds*, vol. 261, pp. 145-149 (Paper C)) which show that  $\beta\text{-MgNiH}$  has transitions in the -4 to -5 ppm region (see p. 48 of "ATTACHMENT in paper #24").

In response to the Examiner's evidence dated 8/23/2001 that  $\beta\text{-MgNiH}$  have transitions in the -4 to -5 ppm region, Turner now qualifies his original statement in the new declaration by adding a new paragraph that the shifts observed in the region from -4 to -5 ppm are only known to be due to transition metal hydrides such as  $\beta\text{-MgNiH}$  but that Ni and Mg were not detected in applicant's sample. Turner does not provide any additional evidence besides relying on the Examiner's provided evidence of  $\beta\text{-MgNiH}$  to support his general statement that shifts in the region from -4 to -5 ppm are only known to be due to transition metal hydrides. Turner's current statement now reflects the evidence provided by the Examiner that  $\beta\text{-MgNiH}$  have transitions in the region of -4 to -5 ppm. Turner does not provide any solid evidence to support his general statement that upfield shifts in the -4 to -5 ppm region are known only to be due to transition metal hydrides. It is inaccurate and illogical to extrapolate a piece of prior art provided by the Examiner showing  $\beta\text{-MgNiH}$  having shifts in the -4 to -5 ppm to the general statement that upfield shifts in the -4 to -5 pm region are known only to be due to

transition metal hydrides.

There is no speculation possible in this case. The contents of the sample are known by elemental analysis and K is not known to produce an upfield NMR shift with ordinary hydride. This result directly shows that new states of hydrogen are formed. Furthermore, these states have been confirmed by Fourier transform infrared (FTIR) spectroscopy which shows the corresponding molecule ( $H_2(1/4)$  corresponding to  $H^-(1/4)$ ). Furthermore, the electron-beam excitation spectrum on the compound KHI confirms the FTIR and NMR results:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.
111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species  $H^-(1/4)$  and  $H_2(1/4)$  as a New Power Source", Thermochimica Acta, submitted.
110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).

## Section 7

The Committee further commits clear error on page 7 of the present Action, arguing that:

Furthermore, applicant's and Turner's assertions that there are no contaminants in the sample are not convincing because these samples were not purified after the synthesis process. Applicant's experimental syntheses of  $KH^*Cl$ ,  $KH^*Br$ , and  $KH^*I$  were made from the corresponding alkali halide  $KCl$ ,  $KBr$ , and  $KI$  using potassium metal as the catalyst and each compound was prepared in a stainless steel glass cell comprising a Ni screen hydrogen dissociator, catalyst, and alkali halide or alkaline earth hydride (see Experimental section on pp. 966-967 of applicant's paper, Mills et al., "Identification of compounds containing novel hydride ions by nuclear magnetic resonance spectroscopy", International Journal of Hydrogen Energy 26 (2001) pp. 965-979). Ni was used as a hydrogen dissociator and can easily be present as a contaminant such as a nickel hydride containing compound in

the resulting products. [Emphasis in original.]

The problem with the Committee's simplistic analysis is that no nickel was detected by elemental analysis in the sample. This is just another example of the Committee's refusal to properly consider Applicant's scientific evidence based on strained reasoning and contrived excuses.

### **Section 8**

The Committee continues its erroneous analysis on page 7 of the Action, asserting that:

Turner states in the new declaration that the only compounds known to have chemical shifts at -4.1 and -4.5 ppm are transition metal hydrides. Therefore, it is the Examiner's position that the peaks at -4.1 ppm and -4.5 ppm can be due to minute amounts of contaminants such as a transition metal hydride containing compound in applicant's samples.

The Committee's position is simply wrong.  $^1\text{H}$  MAS NMR is known not to be a technique for trace analysis. Furthermore, elemental analysis can detect orders of magnitude lower concentrations. Thus, the Committee's proposed speculation that "minute amounts of contaminants such as a transition metal hydride" gives rise to the intense upfield shifted peaks was eliminated.

### **Section 9**

The Committee is also wrong in stating on pages 7-8 of the Action:

Turner's new declaration signed on 8/24/2004 and filed on 12/21/2004 in the present response is different from his original declaration in changing the pulse angle from 15 to 35 in paragraph 7 and adding the new paragraph:

"For sample 080304BLP1, in the  $^1\text{H}$  MAS NMR spectrum two unusual signals were observed, at -4.1 and -4.5 ppm. The only compounds known to have chemical shifts in this region are transition metal hydrides, in particular  $\text{Mg}_2\text{NiH}_4$ . Elemental analysis (Gaibraith Laboratories, Inc., Knoxville, TN) showed that Mg and Ni are not detected in this sample, and that K was the main metal present. Earlier NMR data has shown that the hydride of K appears at about 1.0 ppm. Therefore, these results suggest that the signals at -4.1 and -4.5 ppm represent a novel species, and do not correspond to any known metal hydride."

This new paragraph in Turner's declaration does not provide conclusive support that these upfield shifts are due to a novel species because all possible known transition compounds other than those including Ni that could have upfield shifts in this region have not been ruled out by the applicant or Turner. This new paragraph only states that K was the main metal present. It is silent about what about other metal elements, especially transition metal elements, are present in this sample provided by the applicant.

Transition elements were considered and eliminated by Turner as the source of the up-field shifted peaks using elemental analysis as stated in the Turner declaration. See also Sections 6-8 above.

#### **Section 10**

The Committee seeks desperately to find another excuse to dismiss Applicant's evidence by further erroneously arguing on page 8 of the Action that:

Furthermore, it is also possible that a previously unstudied, ordinary, non-transition metal hydride compound having upfield shifts is present in the sample. [Emphasis in original.]

The elemental analysis performed by Turner, as well that performed and published by Applicant, eliminates this possibility. See:

10. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.

The elemental content sufficient to be detectable by changing the proton NMR shift is shown to be only alkali and halide, which do not produce upfield-shifted NMR peaks as stated in the declaration by Turner, as well as in the following papers:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.
111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani,

"Catalysis of Atomic Hydrogen to Novel Hydrogen Species  $H^-$  (1/4) and  $H_2$  (1/4) as a New Power Source", *Thermochimica Acta*, submitted.

110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," *Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem.* 2005, 50(2).

In addition to elemental analysis, X-ray photoelectron spectroscopy and time-of-flight-secondary-ion-mass-spectroscopy (ToF-SIMs) also confirm the elemental composition as alkali, halide, and hydrogen:

111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species  $H^-$  (1/4) and  $H_2$  (1/4) as a New Power Source", *Thermochimica Acta*, submitted.
110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," *Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem.* 2005, 50(2).
10. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.
8. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", *Int. J. of Hydrogen Energy*, Vol. 26, No. 4, (2001), pp. 339-367.

## **Section 11**

The Committee also mistakenly argues on pages 8-9 of the present Action:

Finally, applicant and Turner both agree that conventional transition metal hydrides have upfield shifts in the -4 to -5S ppm region. Since these NMIR signals are due to the hydrogen atom themselves in these conventional transition metal hydrides as measured by solid state proton NMR, and the position of the signal reflects the surrounding electronic environment of the hydrogen proton, the upfield shifts in these known conventional transition metal hydrides are due to hydrogen protons in a certain electronic environment surrounding the hydrogen protons and are not due to any novel states of the hydrogen atom in the conventional transition

metal hydride compounds. Therefore, upfield shifts of protons in solid state proton NMR are known to be due to the electronic environment of the hydrogen proton that do not involve hydrino form of the hydrogen atom. Hydrinos are not necessary to explain the upfield shifts observed by solid state H NMR as evidenced by known transition metal hydrides having these upfield shifts in the same region.

There is no conventional explanation for the upfield-shifted peak in potassium hydride. The observed shift identically matches that predicted for lower-energy hydrogen. There are confirmations from many techniques. These results are summarized in the following abstracts and reported in the corresponding papers:

112. **R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.**

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states than previously thought possible. Novel emission lines with energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$  were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched  $H(1/p)$ , fractional Rydberg states of atomic hydrogen wherein  $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$ ; ( $p \leq 137$  is an integer) replaces the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy transfer to  $He^+$  acting as a catalyst.  $Ar^+$  and  $K$  also serve as catalysts since, like  $He^+$ , they meet the catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen,  $27.2 \text{ eV}$ .

Two  $H(1/p)$  may react to form  $H_2(1/p)$  that have vibrational and rotational energies that are  $p^2$  times those of  $H_2$  comprising uncatalyzed atomic hydrogen. Rotational lines were observed in

the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of  $4^2$  times that of hydrogen established the internuclear distance as  $1/4$  that of  $H_2$  and identified  $H_2(1/4)$ . The predicted products of alkali catalyst  $K$  are  $H^-(1/4)$  which form a novel alkali halide hydride compound ( $MH^*X$ ) and  $H_2(1/4)$  which may be trapped in the crystal. The  $^1H$  MAS NMR spectrum of novel compound  $KH^*Cl$  relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at  $-4.4$  ppm corresponding to an absolute resonance shift of  $-35.9$  ppm that matched the theoretical prediction of  $H^-(1/p)$  with  $p = 4$ . The predicted catalyst reactions, position of the upfield-shifted NMR peaks for  $H^-(1/4)$ , and spectroscopic data for  $H^-(1/4)$  were found to be in agreement with the experimental observations as well as previously reported analysis of  $KH^*Cl$  containing this hydride ion.

The predicted frequencies of ortho and para- $H_2(1/4)$  were observed at  $1943\text{ cm}^{-1}$  and  $2012\text{ cm}^{-1}$  in the high resolution FTIR spectrum of  $KH^*I$  having a  $-4.6$  ppm NMR peak assigned to  $H^-(1/4)$ . The  $1943/2012\text{ cm}^{-1}$ -intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of  $69\text{ cm}^{-1}$  matched that predicted.  $KH^*Cl$  having  $H^-(1/4)$  by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial  $H_2(1/4)$  as observed in the argon-hydrogen plasma.  $H_2(1/p)$  gas was isolated by liquefaction of plasma gas at liquid nitrogen temperature and by decomposition of compounds ( $MH^*X$ ) found to contain the corresponding hydride ions  $H^-(1/p)$ . The  $H_2(1/p)$  gas was dissolved in  $CDCl_3$  and characterized by  $^1H$  NMR. Considering solvent effects, singlet peaks upfield of  $H_2$  were observed with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm which matched the consecutive series  $H_2(1/2)$ ,  $H_2(1/3)$ ,  $H_2(1/4)$ ,  $H_2(1/5)$ ,  $H_2(1/6)$ , and  $H_2(1/7)$ , respectively.

Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 41.9 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.1 W corresponding to 20.2 W of excess power in  $3\text{ cm}^3$  plasma volume. The excess power density and energy balance were high,  $6.7\text{ W/cm}^3$  and  $-5.4 \times 10^4\text{ kJ/mole } H_2$  ( $280\text{ eV/H atom}$ ), respectively. In addition to power applications, battery and propellant reactions are proposed that may be transformational, and observed excited vibration-rotational levels of  $H_2(1/4)$  could be

the basis of a UV laser that could significantly advance photolithography.

111. **R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species  $H^-(1/4)$  and  $H_2(1/4)$  as a New Power Source", *Thermochimica Acta*, submitted.**

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states than previously thought possible. The predicted reaction involves a resonant, nonradiative energy transfer from otherwise stable atomic hydrogen to a catalyst capable of accepting the energy. The product is  $H(1/p)$ , fractional Rydberg states of atomic hydrogen wherein  $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$ ; ( $p \leq 137$  is an integer) replaces the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states.  $He^+$ ,  $Ar^+$ , and  $K$  are predicted to serve as catalysts since they meet the catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen, 27.2 eV. Specific predictions based on closed-form equations for energy levels were tested. For example, two  $H(1/p)$  may react to form  $H_2(1/p)$  that have vibrational and rotational energies that are  $p^2$  times those of  $H_2$  comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of  $4^2$  times that of hydrogen established the internuclear distance as  $1/4$  that of  $H_2$  and identified  $H_2(1/4)$ .

The predicted products of alkali catalyst  $K$  are  $H^-(1/4)$  which form  $KH^*X$ , a novel alkali halide ( $X$ ) hydride compound, and  $H_2(1/4)$  which may be trapped in the crystal. The  $^1H$  MAS NMR spectrum of novel compound  $KH^*Cl$  relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of  $H^-(1/p)$  with  $p = 4$ . The predicted frequencies of ortho and para- $H_2(1/4)$  were observed at  $1943\text{ cm}^{-1}$  and  $2012\text{ cm}^{-1}$  in the high resolution FTIR spectrum of  $KH^*I$  having a -4.6 ppm NMR peak assigned to  $H^-(1/4)$ . The  $1943/2012\text{ cm}^{-1}$ -intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the



ortho-para splitting of  $69\text{ cm}^{-1}$  matched that predicted.  $KH^*Cl$  having  $H^-(1/4)$  by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial  $H_2(1/4)$  as observed in the argon-hydrogen plasma.  $KNO_3$  and Raney nickel were used as a source of  $K$  catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. The energy balance was  $\Delta H = -17,925\text{ kcal/mole } KNO_3$ , about 300 times that expected for the most energetic known chemistry of  $KNO_3$ , and  $-3585\text{ kcal/mole } H_2$ , over 60 times the hypothetical maximum enthalpy of  $-57.8\text{ kcal/mole } H_2$  due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible  $H_2$  inventory. The reduction of  $KNO_3$  to water, potassium metal, and  $NH_3$  calculated from the heats of formation only releases  $-14.2\text{ kcal/mole } H_2$  which can not account for the observed heat; nor can hydrogen combustion. But, the results are consistent with the formation of  $H^-(1/4)$  and  $H_2(1/4)$  having enthalpies of formation of over 100 times that of combustion.

110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).

Plasmas of certain catalysts such as  $K^+$ ,  $Sr^+$ , and  $Ar^+$  mixed with hydrogen were studied for evidence of a novel energetic reaction. These hydrogen plasmas called resonant transfer- or rt-plasmas were observed to form at low temperatures (e.g.  $\approx 10^3\text{ K}$ ) and an extraordinary low field strengths of about 1-2 V/cm. Time-dependent line broadening of the H Balmer  $\alpha$  line was observed corresponding to extraordinarily fast H (25 eV). Intense hydrogen Lyman emission, a stationary inverted Lyman population, excessive afterglow duration, highly energetic hydrogen atoms, characteristic alkali-ion emission due to catalysis, predicted novel spectral lines, and the measurement of a power beyond any conventional chemistry were also observed. Using a number of spectroscopic and analytical techniques, the reaction products were identified as atoms with energies that are an extension of the Rydberg series to lower states as well as the corresponding molecules and hydride ions. The results show the feasibility of this highly exothermic reaction as a new energy source.

## Section 12

Continuing its error-plagued analysis, the Committee incorrectly asserts on page 9 of the present Action:

With respect to applicant's assertion on pages 58-95 of the present response that there are 51 independent test results, a close examination of these 51 independent test results are mostly applicant's own work or those of his collaborators as stated and addressed in sections 19-25 of the ATTACHMENT IN PAPER #24 and in Part I of the attached appendix. Applicant's own work and those of his collaborators cannot be considered independent test results.

Applicant takes strong exception to these statements. The cited researchers who have repeated Applicant's experiments are independent and would not compromise their professional reputations by producing invalid data. In fact, pressure from peers, and in particular activist physicists that are out to defend quantum theory, have applied great pressure on independent validators to come to conclusions that do not support Applicant's results. Many of the researchers were not paid or very little support was provided. Some of them also came from testing laboratories for which it can not be claimed that they were collaborators. Since the technology is novel, Applicant's employees have assisted in replications, which further supports the validity of the results. Otherwise, Applicant would avoid collaborations with outside researchers. Applicant actively seeks validation.

### **Section 13a**

The Committee states on page 9 of the present Action:

With respect to applicant's allegations on page 106 of the response of the Examiner being biased by Quantum Mechanics (QM), this issue is addressed on pages 33-34 of the attached appendix.

Applicant addresses this issue in his response to the cited Appendix pages.

### **Section 13b**

The Committee continues by arguing on page 9 of the Advisory Action:

With respect to applicant's assertion on page 122 of the present response that his predicted previously unknown lower-energy hydrogen having fractional quantum numbers do not contradict, but rather, supplement the well-known higher energy states of hydrogen having integer quantum numbers, the Examiner disagrees for reasons given in sections 9 and 10 of the ATTACHMENT IN PAPER #24 that quantum mechanics forbids fractional quantum numbers for the energy levels of the hydrogen atom. Applicant's statement misinterprets conventional quantum mechanics which forbids these fractional quantum numbers in hydrogen atoms.

That is absolutely not true. Quantum theory is postulated and depending on the constant inserted in the corresponding differential equation, any energy level is possible. This issue is discussed in:

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

### **Section 13c**

The Committee further asserts, without basis, on pages 9-10 of the Advisory Action:

Applicant asserts on page 123 of the response that the Examiner's "conventional acceptance" standard introduces all sorts of inherent problems, among them the required degree of acceptance by the scientific community and the great length of time it often takes for such acceptance to take hold and that the Examiner's odd position appears to be that discoveries that are so novel as to require years to be scientifically accepted such as the Einstein's theory of relativity took decades to gain acceptance, is a sufficient basis for denying patent protection for inventions based on those discoveries. The applicant also asserts that the conventional acceptance standard is not supported by legal authority and that applicant can cite to any number of inventions that were granted patented protection based on unconventional approaches to well known problems.

In response, applicant appears to be admitting and agreeing with the Examiner that his theory has not been accepted by the scientific community. Moreover, applicant states on page 123 of the present response that he “does not dispute the fact that until he put forward his novel theory, no established modern theory of science predicted the existence of lower energy states of hydrogen” and that all that proves is “the absolute novelty of Applicant’s claimed invention, thus providing an additional basis for why Applicant is entitled to a patent”. However, applicant appears to be misinterpreting patent law and legal precedent. Applicant’s example of Einstein’s theory of relativity is irrelevant because Einstein did not seek to and could not patent his discovery of the laws of nature (see the text of 35 USC 101).

Applicant most certainly does not agree with the Committee on any of these points. First, as stated numerous times—and never rebutted by the Committee—the “acceptance by the scientific community” standard imposed in this case has no legal support whatsoever. Second, even under this improper standard, Applicant has repeatedly shown in his Responses, including this one, that his scientific evidence of lower-energy hydrogen has gained acceptance in the scientific community. The failure to effectively rebut that evidence merely highlights the desperation reflected in the Committee’s latest arguments.

The Committee’s further assertions regarding Einstein’s theory of relativity similarly fall flat. Applicant fails to see what that has anything to do with Applicant’s entitlement to patents covering his development of pioneering technologies in the field of hydrogen chemistry. This latest irrelevant argument is yet another example of the Committee’s intention to deny Applicant a fair and expeditious examination in this case.

### **Section 13d**

The Committee further presents strained arguments on pages 10-11 of its Advisory Action that are no more convincing:

Furthermore, legal precedent in conjunction with patent law (see MPEP 2107.01) deny patentability of an invention that is inconsistent with known scientific principles such that the utility asserted by the applicant is thought to be incredible in the light of

the knowledge of the art. *In re Citron*, 325 F.2d 248, 253, 139 USPQ 516, 520 (CCPA 1963).

A good example of a novel "discovery" is cold fusion that can take years to (or never) be accepted by the scientific community and currently, the court has held that an invention based on cold fusion is not patentable because cold fusion is not a credible process of producing energy. *In re Swartz*, 232 F.3d 862, 56 USPQ2d 1703, (Fed. Cir. 2000). The applicant's argument that unconventional approaches to well known problems have been patented is not persuasive because these unconventional approaches are not inconsistent with known scientific principles whereas applicant's theory of the hydrino atom is inconsistent with known scientific principles and has not been accepted by the scientific community. Therefore, the Examiner's position denying patentability of applicant's incredible invention that is inoperative and lacks utility (under 35 USC101) is not odd but it is in agreement with office policy (see MPEP 2107.01) rooted in patent law and legal precedent.

These backward arguments merely demonstrate the Committee's profound confusion and total lack of appreciation for even the most basic principles underlying Applicant's novel hydrogen technology. Quantum theory is just that, a theory, yet the Committee now equates it to a law of nature. Ironically, Applicant's theory, which led him to the discovery of lower energy states of hydrogen, is based on classical laws of nature and, thus, contrary to the Committee's misplaced views, is consistent with known scientific principles. The Committee's assertions to the contrary as a basis for assuming Applicant's invention to be *per se* incredible and rejecting claims in this case is therefore completely erroneous and must be withdrawn.

Furthermore, as discussed many times previously, the Committee's assumption that Applicant's technology is *per se* incredible as an excuse to dismiss Applicant's scientific evidence without a fair hearing is not in agreement with office policy and most certainly is not rooted in patent law or other legal precedent. To the contrary, even the PTO's own policy proscribes such action and mandates that all supporting scientific evidence be properly considered before jumping to conclusions.

Unfortunately, the Committee once again chooses to hide behind its contrived standard of "acceptance by the scientific community" to avoid a fair hearing on Applicant's evidence. For the many reasons already stated, that tactic must also fail.

#### **Section 14**

The Committee wrongly accuses Applicant of error on pages 11-12 of the Advisory Action, when, in fact, it has erred by arguing that:

With respect to astrophysical data as support of his hydrino theory, applicant continues to misinterpret the data of Labov and Bowyer on pages 126-129 of the present response where applicant assigns transitions observed by Labov and Bowyer as being due to the hydrino. The astrophysical data provided by Labov and Bowyer can be explained by conventional science without the need to use applicant's scientifically implausible theory of the hydrino atom. According to the document titled "Hydrocatalysis Technical Assessment, Prepared for Pacificorp, prepared by Technology Insights, dated August 2, 1996", submitted by applicant on 7/17/2002 in copending application 09/669,877, Labov and Bowyer dispute applicant's interpretation of their data. The applicant of the present application is the founder of Hydrocatalysis Power Corporation (HPC) now known as Blacklight Power, Inc. Pages 20-21 of the document states that spectra! data taken from the reference S. Labov and S. Bowyer, "Spectral Observations of the Extreme Ultraviolet Background", The Astrophysics Journal, 371, 810 (1991), were evaluated by HPC for indications of hydrino. HPC assigned peaks in the wavelength region of 80 to 650 Å to hydrino transitions. As shown in Table 4-1 on page 21 of the document, the HPC assignments contradict the alternative assignments made by the authors of the paper.

The Committee apparently does not seem to recognize that the explanation given by Labov and Bowyer is not credible based on discussions by the authors themselves. From Ref. #28 R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322:

#### **B. Identification of Lower-Energy Hydrogen by Soft X-rays from Dark Interstellar Medium**

**a. Dark Matter**

The Universe is predominantly comprised of hydrogen and a small amount of helium. These elements exist in interstellar regions of space, and they are expected to comprise the majority of interstellar matter. However, the observed constant angular velocity of many galaxies as the distance from the luminous galactic center increases can only be accounted for by the existence of nonluminous weakly interacting matter, dark matter. Dark matter exists at the cold fringes of galaxies and in cold interstellar space. It may account for the majority of the universal mass.

The identity of dark matter has been a cosmological mystery. Postulated assignments include neutrinos, but a detailed search for signature emissions has yielded nil [49]. The search for signatures by the Cryogenic Dark Matter Search (CDMS) developed to detect theorized Weakly Interacting Massive Particles (WIMPs) has similarly yielded nil [50-51]. WIMP theory's main competitor known as MACHO theory which assigns the dark matter to Massive Compact Halo Objects (MACHOs) which rather than elusive subatomic particles comprises ordinary baryonic matter in the form of burned-out dark stars, stray planets, and other large, heavy, but dark objects that must be ubiquitous throughout the universe. However, MACHO theory has also recently been ruled out based on lack of evidence of these dark objects observable by the brief ellipses caused by them moving in front of distant stars. Only a few such objects have been observed after exhaustively searching for over five years [50, 52].

It is anticipated that the emission spectrum of the extreme ultraviolet background of interstellar matter possesses the spectral signature of dark matter. Labov and Bowyer designed a grazing incidence spectrometer to measure and record the diffuse extreme ultraviolet background [53]. The instrument was carried aboard a sounding rocket, and data were obtained between 80 Å and 650 Å (data points approximately every 1.5 Å). Several lines including an intense 635 Å emission associated with dark matter were observed [53] which has considerable astrophysical importance as indicated by the authors:

"Regardless of the origin, the 635 Å emission observed could be a major source of ionization. Reynolds (1983, 1984, 1985) has shown that diffuse H $\alpha$  emission is ubiquitous throughout the Galaxy, and widespread sources of flux shortward of 912 Å are

required. Pulsar dispersion measures (Reynolds 1989) indicate a high scale height for the associated ionized material. Since the path length for radiation shortward of  $912 \text{ \AA}$  is low, this implies that the ionizing source must also have a large scale height and be widespread. Transient heating appears unlikely, and the steady state ionization rate is more than can be provided by cosmic rays, the soft X-ray background, B stars, or hot white dwarfs (Reynolds 1986; Brushweiler & Cheng 1988). Sciama (1990) and Salucci & Sciama (1990) have argued that a variety of observations can be explained by the presence of dark matter in the galaxy which decays with the emission of radiation below  $912 \text{ \AA}$ .

The flux of  $635 \text{ \AA}$  radiation required to produce hydrogen ionization is given by  $F = \zeta_H / \sigma_\lambda = 4.3 \times 10^4 \zeta_{-13} \text{ photons cm}^{-2} \text{ s}^{-1}$ , where  $\zeta_{-13}$  is the ionizing rate in units of  $10^{-13} \text{ s}^{-1}$  per  $H$  atom. Reynolds (1986) estimates that in the immediate vicinity of the Sun, a steady state ionizing rate of  $\zeta_{-13}$  between 0.4 and 3.0 is required. To produce this range of ionization, the  $635 \text{ \AA}$  intensity we observe would have to be distributed over 7% - 54% of the sky."

The first soft X-ray background was detected and reported [54] about 25 years ago. Quite naturally, it was assumed that these soft X-ray emissions were from ionized atoms within hot gases. Labov and Bowyer also interpreted the data as emissions from hot gases. However, the authors left the door open for some other interpretation with the following statement from their introduction:

"It is now generally believed that this diffuse soft X-ray background is produced by a high-temperature component of the interstellar medium. However, evidence of the thermal nature of this emission is indirect in that it is based not on observations of line emission, but on indirect evidence that no plausible non-thermal mechanism has been suggested which does not conflict with some component of the observational evidence."

The authors also state that "if this interpretation is correct, gas at several temperatures is present." Specifically, emissions were attributed to gases in three ranges:  $5.5 < \log T < 5.7$ ;  $\log T = 6$ ;  $6.6 < \log T < 6.8$ .

The explanation proposed herein of the observed dark interstellar medium spectrum hinges on the possibility of energy states below the  $n = 1$  state, as given by Eqs. (2a) and (3). A number of experimental observations discussed in the Introduction section lead to the conclusion that atomic hydrogen can exist in



fractional quantum states that are at lower energies than the traditional "ground" ( $n = 1$ ) state. The existence of fractional quantum states of hydrogen atoms explains the spectral observations of the extreme ultraviolet background emission from interstellar space [53], which may characterize dark matter as demonstrated in Table 3. (In these cases, a hydrogen atom in a fractional quantum state,  $H(n_i)$ , collides, for example, with a  $n = \frac{1}{2}$

hydrogen atom,  $H\left(\frac{1}{2}\right)$ , and the result is an even lower-energy

hydrogen atom,  $H(n_f)$ , and  $H\left(\frac{1}{2}\right)$  is ionized.



The energy released, as a photon, is the difference between the energies of the initial and final states given by Eqs. (2a) and (3) minus the ionization energy of  $H\left(\frac{1}{2}\right)$ , 54.4 eV.

Thus, lower-energy transitions of the type,

$$\Delta E = \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \times 13.6 \text{ eV} - 54.4 \text{ eV} \quad n = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \text{ and}$$

$$n_i > n_f \quad (56)$$

induced by a disproportionation reaction with  $H\left[\frac{a_H}{2}\right]$  ought to occur. The wavelength is related to  $\Delta E$  by

$$\lambda \text{ (in } \text{\AA}) = \frac{1.240 \times 10^4}{\Delta E \text{ (in eV)}} \quad (57)$$

The energies and wavelengths of several of these proposed transitions are shown in Table 2. Note that the lower energy transitions are in the soft X-ray region.

## b. The Data And Its Interpretation

In their analysis of the data, Labov and Bowyer [53] established several tests to separate emission features from the background. There were seven features (peaks) that passed their criteria. The wavelengths and other aspects of these peaks are shown in Table 3. Peaks 2 and 5 were interpreted by Labov and Bowyer as instrumental second-order images of peaks 4 and 7, respectively. Peak 3, the strongest feature, is clearly a helium resonance line:  $He(1s^1 2p^1 \rightarrow 1s^2)$ . At issue here, is the interpretation of peaks 1, 4, 6, and 7. It is proposed that peaks 4, 6,

and 7 arise from the  $\frac{1}{3} \rightarrow \frac{1}{4}$ ,  $\frac{1}{4} \rightarrow \frac{1}{5}$ , and  $\frac{1}{6} \rightarrow \frac{1}{7}$  hydrogen atoms transitions given by Eq. (55). It is also proposed that peak 1 arises from inelastic helium scattering of peak 4. That is, the  $\frac{1}{3} \rightarrow \frac{1}{4}$

transition yields a 40.8 eV photon (303.9 Å). Conspicuously absent is the 256 Å (48.3 eV) line of He II which eliminates the assignment of the majority of the 303 Å line to the He II transition. When this photon strikes He (1s<sup>2</sup>), 21.2 eV is absorbed in the excitation to He (1s<sup>1</sup>2p<sup>1</sup>). This leaves a 19.6 eV photon (632.6 Å), peak 1. For these four peaks, the agreement between the predicted values (Table 2) and the experimental values (Table 3) is remarkable.

One argument against this new interpretation of the data is that the transition  $\frac{1}{5} \rightarrow \frac{1}{6}$  is missing—predicted at 130.2 Å by Eqs. (56-57). This missing peak cannot be explained into existence, but a reasonable rationale can be provided for why it might be missing from these data. The data obtained by Labov and Bowyer are outstanding when the region of the spectrum, the time allotted for data collection, and the logistics are considered. Nonetheless, it is clear that the signal-to-noise ratio is low and that considerable effort had to be expended to differentiate emission features from the background. This particular peak,  $\frac{1}{5} \rightarrow \frac{1}{6}$ , is likely to be only

slightly stronger than the  $\frac{1}{6} \rightarrow \frac{1}{7}$  peak (the intensities, Table 3, appear to decrease as *n* decreases), which has low intensity. Labov and Bowyer provided their data (wavelength, count, count error, background, and background error). The counts minus background values for the region of interest, 130.2 ± 5 Å, are shown in Table 4 (the confidence limits for the wavelength of about ±5 Å are the single-side 1 confidence levels and include both the uncertainties in the fitting procedure and uncertainties in the wavelength calibration). Note that the largest peak (count – background) is at 129.64 Å and has a *counts – background* = 8.72. The *counts – background* for the strongest signal of the other hydrino transitions are: *n* = 1/3 to *n* = 1/4, 20.05; *n* = 1/4 to *n* = 1/5, 11.36; *n* = 1/6 to *n* = 1/7, 10.40. Thus, there is fair agreement with the wavelength and the strength of the signal. This, of course, does not mean that there is a peak at 130.2 Å. However, it is not unreasonable to conclude that a spectrum with a better signal-to-noise ratio might uncover the missing peak. With the assignment of the  $\frac{1}{5} \rightarrow \frac{1}{6}$  transition, all of the hydrogen transitions  $\frac{1}{3} \rightarrow \frac{1}{4}$ ,  $\frac{1}{4} \rightarrow \frac{1}{5}$ ,

$\frac{1}{5} \rightarrow \frac{1}{6}$ , and  $\frac{1}{6} \rightarrow \frac{1}{7}$  are observed over the recorded spectral range, and the 632.6 Å peak is identified.

### **Section 15**

On page 12 of its Action, the Committee further argues that:

Page 21 of the document also states that Bowyer (an astrophysicist and author of the astrophysics journal paper cited above) disputed the HPC interpretation of the data and that the paper on the HPC interpretation submitted to the Astrophysical Letters and Communications was not accepted for publication. The document also states on page 21 that the low energy hydrogen concept and its implications regarding data interpretation has not received general review or acceptance by the astrophysics community. Thus, applicant's assertions regarding the existence of hydrino based on observations of radiation spectra from space, i.e., astrophysical data, have not been accepted by the astrophysics community as evidenced by the document submitted by applicant on 7/17/2002 in copending application 09/669,877 since a more credible scientific alternative exists to explain the spectral data.

The explanation given by Labov and Bowyer is not credible as discussed above in Section 21 of this Response. The data matches hydrinos. The data is now published in a peer-reviewed journal: 28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322. The assignment to hydrino has further been validated by the identification of hydrino lines. Several peer-reviewed articles have been published that directly show and assign the hydrino spectra lines:

67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.
50. R. L. Mills, P. Ray, J. Dong, M. Nansteel, B. Dhandapani, J. He, "Spectral Emission of Fractional-Principal-Quantum-Energy-Level Atomic and Molecular Hydrogen", Vibrational Spectroscopy, Vol. 31, No. 2, (2003), pp. 195-213.

33. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.
29. R. Mills, P. Ray, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Hydrogen Molecular Ion", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 533-564.
28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322.

Assignments to known species and contaminants were investigated and ruled out. For example, extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of  $q \cdot 13.6 \text{ eV}$ ,  $q = 1, 2, 3, 7, 9, 11$ . or  $q \cdot 13.6 \text{ eV}$ ,  $q = 4, 6, 8$  less  $21.2 \text{ eV}$  corresponding to inelastic scattering of these photons by helium atoms due to excitation of  $He(1s^2)$  to  $He(1s^1 2p^1)$ . These strong emissions are not found in any single gas plasma, and cannot be assigned to the known emission of any species of the single gases studied such as  $H$ ,  $H^-$ ,  $H_2$ ,  $H_2^+$ ,  $H_3^+$ ,  $He$ ,  $He_2^+$ , and  $He^+$ , known species of the mixture such as  $He_2^+$ ,  $HeH^+$ ,  $HeH$ ,  $HHe_2^+$ , and  $HHe_n^+$  and  $He_n$ , or possible contaminants as given in Ref. 67.

J. Phys. D is a top-tiered physics journal. The spectra were extensively peer reviewed. The publication unequivocally assigns the lines to hydrino as shown explicitly in journal article #67:

The elimination of known explanations indicate a new result. Since the novel peaks were only observed with helium and hydrogen present, new hydrogen, helium, or helium-hydrogen species are possibilities. It is well known that empirically the excited energy states of atomic hydrogen are given by Rydberg equation (Eq. (2a) for  $n > 1$  in Eq. (2b)).

$$E_n = -\frac{e^2}{n^2 8 \pi \epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

The  $n = 1$  state is the "ground" state for "pure" photon transitions (i.e. the  $n = 1$  state can absorb a photon and go to an excited

electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [47]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [48].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as  $He^+$  which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen,  $m \cdot 27.2 \text{ eV}$  wherein  $m$  is an integer. The theory was given previously [49]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer; } p \leq 137 \quad (2c)$$

replaces the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states. Thus, the Rydberg states are extended to lower levels as depicted in Figure 9. The  $n = 1$  state of hydrogen and the  $n = \frac{1}{\text{integer}}$  states of hydrogen are nonradiative,

but a transition between two nonradiative states is possible via a nonradiative energy transfer, say  $n = 1$  to  $n = 1/2$ . Thus, a catalyst provides a net positive enthalpy of reaction of  $m \cdot 27.2 \text{ eV}$  (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at  $91.2 \text{ nm}$ ,  $45.6 \text{ nm}$ ,  $30.4 \text{ nm}$ ,  $13.03 \text{ nm}$ ,  $10.13 \text{ nm}$ , and  $8.29 \text{ nm}$  correspond to energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 7, 9, 11$ . In order of energy, the set comprising the peaks at  $37.4 \text{ nm}$ ,  $20.5 \text{ nm}$ , and  $14.15 \text{ nm}$  correspond to energies of  $q \cdot 13.6 - 21.21 \text{ eV}$  where  $q = 4, 6, 8$ . These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the

second ionization energy of helium is  $54.417 \text{ eV}$ , which is equivalent to  $2 \cdot 27.2 \text{ eV}$ . In this case,  $54.417 \text{ eV}$  is transferred nonradiatively from atomic hydrogen to  $\text{He}^+$  which is resonantly ionized. The electron decays to the  $n = 1/3$  state with the further release of  $54.417 \text{ eV}$  which may be emitted as a photon. The catalysis reaction is

$$54.417 \text{ eV} + \text{He}^+ + \text{H}[a_H] \rightarrow \text{He}^{2+} + e^- + \text{H}\left[\frac{a_H}{3}\right] + 108.8 \text{ eV} \quad (3)$$

$$\text{He}^{2+} + e^- \rightarrow \text{He}^+ + 54.417 \text{ eV} \quad (4)$$

And, the overall reaction is

$$\text{H}[a_H] \rightarrow \text{H}\left[\frac{a_H}{3}\right] + 54.4 \text{ eV} + 54.4 \text{ eV} \quad (5)$$

Since the products of the catalysis reaction have binding energies of  $m \cdot 27.2 \text{ eV}$ , they may further serve as catalysts. Thus, further catalytic transitions may occur:  $n = \frac{1}{3} \rightarrow \frac{1}{4}$ ,  $\frac{1}{4} \rightarrow \frac{1}{5}$ , and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of  $m \cdot 27.2 \text{ eV}$  would give rise to a series of emission lines of energies  $q \cdot 13.6 \text{ eV}$  where  $q$  is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction

$$\text{H}[a_H] \xrightarrow{\text{He}^+} \text{H}\left[\frac{a_H}{3}\right] + 54.4 \text{ eV} + 54.4 \text{ eV} \quad (6)$$

yields  $54.4 \text{ eV}$  by Eq. (4) and a photon of  $54.4 \text{ eV}$  ( $22.8 \text{ nm}$ ). Once emitted, the photon may be absorbed or scattered. When this photon strikes  $\text{He}(1s^2)$ ,  $21.2 \text{ eV}$  may be absorbed in the excitation to  $\text{He}(1s^1 2p^1)$ . This leaves a  $33.19 \text{ eV}$  ( $37.4 \text{ nm}$ ) photon peak and a  $21.21 \text{ eV}$  ( $58.4 \text{ nm}$ ) photon from  $\text{He}(1s^1 2p^1)$ . Thus, for helium the inelastic scattered peak of  $54.4 \text{ eV}$  photons from Eq. (3) is given by

$$E = 54.4 \text{ eV} - 21.21 \text{ eV} = 33.19 \text{ eV} \quad (37.4 \text{ nm}) \quad (7)$$

A novel peak shown in Figures 2-4 was observed at  $37.4 \text{ nm}$ . Furthermore, the intensity of the  $58.4 \text{ nm}$  peak corresponding to the spectra shown in Figure 4 was about 60,000 photons/sec. Thus, the transition  $\text{He}(1s^2) \rightarrow \text{He}(1s^1 2p^1)$  dominated the inelastic scattering of EUV peaks. The general reaction is

$$\text{photon}(h\nu) + \text{He}(1s^2) \rightarrow \text{He}(1s^1 2p^1) + \text{photon}(h\nu - 21.21 \text{ eV}) \quad (8)$$

The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are  $13.6 \text{ eV}$ ,  $27.2 \text{ eV}$ ,  $40.8 \text{ eV}$ ,  $54.4 \text{ eV}$ ,  $81.6 \text{ eV}$ ,  $95.2 \text{ eV}$ ,  $108.8 \text{ eV}$ ,  $122.4 \text{ eV}$  and  $149.6 \text{ eV}$ . The corresponding peaks are  $91.2 \text{ nm}$ ,  $45.6 \text{ nm}$ ,  $30.4 \text{ nm}$ ,  $37.4 \text{ nm}$ ,  $20.5 \text{ nm}$ ,  $13.03 \text{ nm}$ ,  $14.15 \text{ nm}$ ,  $10.13 \text{ nm}$ , and  $8.29 \text{ nm}$ ,

respectively. Thus, the identified novel lines correspond to energies of  $q \cdot 13.6 \text{ eV}$ ,  $q = 1, 2, 3, 7, 9, 11$ . or  $q \cdot 13.6 \text{ eV}$ ,  $q = 4, 6, 8$  less  $21.2 \text{ eV}$  corresponding to inelastic scattering of these photons by helium atoms due to excitation of  $\text{He}(1s^2)$  to  $\text{He}(1s^1 2p^1)$ . The values of  $q$  observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [50]. The broad satellite peak at  $44.2 \text{ nm}$  show in Figure 2-4 is consistent with the reaction mechanism of a nonradiative transfer to a catalyst followed by emission. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the  $q \cdot 13.6 \text{ eV}$  related set of peaks.

## **Section 16**

On page 12 of the Action, the Committee incorrectly claims that:

In response to applicant's assertions that the explanation given by Labov and Bowyer are not credible, applicant does not give any reasons why the astrophysicists' explanation of their own data is not credible. Applicant also asserts that the authors' data matches hydrinos. In response, a paper by Aaron Barth cited in the attached appendix disputes applicant's assignment of the Labov and Bowyer data to hydrino transitions (A.J. Barth, "Bigger Than Fire?", SKEPTIC Vol. 8, No. 4, 2001).

Contrary to the Committee's remarks, Applicant has indeed given reasons why Labov and Bowyer's explanations are not credible. With regard to Barth, he states that the lines identified as hydrino lines in the data of EQ Pegasi are below the signal-to-noise level. Barth is a standard quantum devotee, as demonstrated by his preposterous statement in the "South of the South Pole" section of his article: "In terms of its stunning ability to make quantitative predictions that agree accurately with experimental results, quantum theory is the most successful theory ever devised". Barth's intent in publishing his article in Skeptic's Magazine was to discredit Applicant's work so he selectively chose this spectrum over that of Labov and Bowyer also in the cited Mills GUT. In the latter case, Barth's argument is overturned since the lines assigned to hydrino by Applicant are

identified by Labov and Bowyer as statistically significant and difficult to assign to known species given the nature of the surveyed interstellar regions as not emitting visible light as discussed previously.

### **Section 17**

The Committee also wrongly asserts on page 12 of the Action that:

Applicant continues to misinterpret quantum mechanics (QM) on pages 130-147 of the present response. These misinterpretations are rebutted in Part II of the attached appendix and have been rebutted in all of the arguments made by the Examiner in the previous Office actions and previous attached appendixes to the Office actions.

Applicant responds to the assertions in Part II in his corresponding Appendix submitted herewith.

### **Section 18**

On page 13 of the present Action, the Committee commits further error in asserting that:

Applicant's arguments on pages 163-173 of the present response with respect to the plasma references cited by the Examiner show that he has seriously misinterpreted the Examiner's statements and that he does not understand the crucial point that the Examiner made in the previous office action regarding applicant's anomalous line broadening data. The Examiner's main point was that microwave plasma experiments containing hydrogen and one of Ar or He do not cause anomalous line broadening in contrast to applicant's data and applicant does not explain why the microwave experiments of Luque and Luggenhoelscher do not cause anomalous line broadening even though hydrogen and Ar or He (H, Ar, and He are regarded as a catalyst in applicant's experiments and theory) are present in the experiments. According to applicant's arguments and his data, a plasma containing Ar and hydrogen would show anomalous line broadening due to the resonance transfer mechanism of Ar with hydrogen but this anomalous line broadening effect was absent in the microwave experiments of the prior art cited by the Examiner.

It is crucial to note Luque did not observe Ar catalyzing hydrogen atoms in his microwave discharge experiments (that



would be evidenced by anomalous line broadening according to applicant's arguments) in direct contrast to applicant's microwave discharge experiments with Ar and hydrogen and applicant does not deny that Luque did not observe anomalous line broadening in his microwave experiments containing Ar and hydrogen.

The Committee's arguments have no merit whatsoever. The broadening in Applicant's work was observed in an Evenson microwave cell that is one of the best known cavities for producing ions required in the case of the hydrino reaction since  $\text{Ar}^+$  and  $\text{He}^+$  are the catalyst. The broadening was found to be dependent on time and flow rate that are indicative of a chemical reaction. In contrast, Luque's experiments did not use an Evenson cavity and were not performed with variation the flow rate or run for long duration.

The Committee is changing its story and attributing it to a misunderstanding on the part of Applicant, which is not true. The Committee's position is clear from its prior statement, in which it incorrectly argued that broadening was observed and could be attributed to conventional explanations:

Applicant points out that the reasons for Balmer line broadening are discussed in many articles, and that the observed broadening is in excess in what can be expected from known sources thereof. This is not persuasive because broadening may be caused by various means including those taken into account by applicant, and those not taken into account. In the enclosed article by Luggenholscher, et. al. , broadening equivalent to that found by applicant, shown in figure 1, is accounted for by conventionally known explanations such as the Stark effect. The enclosed article by Luque et. al. accounts for H $\alpha$  broadening using two Lorentzian mechanisms (Stark and Van der Waals) and two Gaussian mechanisms (Doppler and instrumental).

### **Section 19**

The Committee continues to misapprehend the evidence of record as demonstrated by the following arguments on page 14 of the Action:

Applicant has also seriously misinterpreted the Examiner's plasma arguments by incorrectly comparing the Examiner's cited line broadening of 0.16 nm in the prior art with >100 eV hot H found in applicant's rt-plasmas. Due to applicant's misinterpretation of the

Examiner's statements, the data of the prior art and his own data, he incorrectly states that the line broadening observed in Luggenhoelscher is off by six orders of magnitude as compared to applicant's observed line widths on page 169 of the present response. The applicant's misinterpretation of the Examiner's remarks on his plasma data, those of the cited prior art, and his own data are detailed on pages 6-12 of the attached appendix (Part I, section B (subsections d.1-d.6, e, and f)).

Again, Applicant strongly disagrees. A broadening of 0.16 nm corresponds to 10 eV. The observation of such large broadening with a catalyst (Ar+) and hydrogen in a microwave cell confirms Applicant's result. Such broadening can not be explained by the Stark effect or other conventional explanations. Specifically, from 49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer  $\alpha$  Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355:

Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman  $\alpha$  line, the Stark width exceeds the Doppler width only at  $n_e > 10^{17} \text{ cm}^{-3}$  for temperatures of about  $10^4 \text{ K}$  [34]. Gigosos and Cardenoso [35] give the observed Balmer  $\alpha$  Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer  $\alpha$  line recorded on a  $H + He^+$  plasma is only 0.033 nm with  $T_e = 20,000 \text{ K}$  and  $n_e = 1.4 \times 10^{14} \text{ cm}^{-3}$ .

The relationship between the Stark broadening  $\Delta\lambda_s$  of the Balmer  $\beta$  line in nm, the electron density  $n_e$  in  $\text{m}^{-3}$ , and the electron temperature  $T_e$  in K is

$$\log n_e = C_0 + C_1 \log(\Delta\lambda_s) + C_2 [\log(\Delta\lambda_s)]^2 + C_3 \log(T_e) \quad (5)$$

where  $C_0 = 22.578$ ,  $C_1 = 1.478$ ,  $C_2 = -0.144$ , and  $C_3 = 0.1265$  [36].

From Eq. (5), to get a Stark broadening of only 0.1 nm with  $T_e = 9000 \text{ K}$ , an electron density of about  $n_e \sim 3 \times 10^{15} \text{ cm}^{-3}$  is required, compared to that of the argon-hydrogen plasma of  $< 10^9 \text{ cm}^{-3}$  determined using a compensated Langmuir probe, over

six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed  $10^9 \text{ cm}^{-3}$ , and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer  $\beta$ ,  $\gamma$ , and  $\delta$  was comparable to that of Balmer  $\alpha$ ; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number  $n$  into  $(2n - 1)$  equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about  $2 \times 10^{-2} \text{ nm} / \text{kV} \cdot \text{cm}^{-1}$ . No appreciable applied electric field was present in our study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

The broadening is unequivocally Doppler broadening as discussed in Reference Nos. 49 and 37. The microwave-field broadening reported in the Committee's cited Luque et al paper is six orders of magnitude too low to account for the broadening reported by Applicant (e.g. Ref. #49).

Specifically, the broadening reported in the Committee's cited reference URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf> is 0.37 cm<sup>-1</sup> with no field and 3.7 cm<sup>-1</sup> with the application of the microwave field. The energies corresponding to these widths are  $4.5 \times 10^{-5} \text{ eV}$  and  $4.5 \times 10^{-4} \text{ eV}$ , respectively,

which is absolutely negligible compared to the  $>10$  eV hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The Committee's alternative explanation is off by six orders of magnitude. Thus, the Stark and microwave field effects originally argued by the Committee are eliminated as the basis of the broadening observed in Applicant's cells.

## **Section 20**

The Committee further mistakenly argues on page 14 of the present Action that:

As explained in Part I of the attached appendix, applicant's assertion of anomalous line broadening in his plasma data due to the resonance transfer (r-t) mechanism is not plausible because there are alternative, conventional explanations for this increased line broadening. The plasma sheath effect offered by the prior art is a more plausible explanation for the increased line broadening than applicant's rt mechanism involving the postulated hydrino (see E. Kovacevic et al., "The Dynamic Response of the Plasma on the Dust Formation in Ar/C<sub>2</sub>H<sub>2</sub> RF Discharges" at <http://www.icpig.uni-greifswald.de/proceedings/data/Kovacevic> I and Cvetanovic et al., *J. Appl. Phys.* 97, 033302-1, 2005 that are both cited in the attached appendix).

Applicant measures line broadening in regions where there is no electric field, which eliminates the "plasma sheath" explanation. See 51. **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. This is the third in a series of papers by our team on apparently anomalous Balmer series line broadening in hydrogen containing RF generated, low pressure ( $< 600$  mTorr) plasmas. In this paper the selective broadening of the atomic hydrogen lines in pure H<sub>2</sub> and Ar/H<sub>2</sub> mixtures in a large "GEC" cell (36 cm length X 14 cm ID) was mapped as a function of position, H<sub>2</sub>/Ar ratio, time, power, and pressure. Several observations regarding the selective line broadening were particularly notable as they are unanticipated

on the basis of earlier models. First, the anomalous broadening of the Balmer lines was found to exist throughout the plasma, and not just in the region between the electrodes. Second, the broadening was consistently a complex function of the operating parameters particularly gas composition (highest in pure H<sub>2</sub>) position, power and pressure. Clearly not anticipated by earlier models were the findings that under some conditions the highest concentration of "hot" (>10 eV) hydrogen was found at the entry end, and not in the high field region between the electrodes and that in other conditions, the hottest H was at the (exit) pump (also grounded electrode) end. Third, excitation and electron temperatures were less than one eV in all regions of the plasma not directly adjacent (>1mm) to the electrodes, providing additional evidence that the energy for broadening, contrary to standard models, is not obtained from the field. Fourth, in contrast to our earlier studies of hydrogen/helium and water plasmas, we found that in some conditions 98% of the atomic hydrogen was in the "hot" state throughout the GEC cell. Virtually every operating parameter studied impacted the character of the hot H atom population, and clearly second and third order effects exist, indicating a need for experimental design. Some non-field mechanisms for generating hot hydrogen atoms, specifically those suggested by Mills' CQM model, are outlined.

This paper also evaluates the broadening as a function of angle with respect to the electrode. No relationship is observed, which eliminates the "sheath" explanation. Furthermore, the broadening is essentially independent of the electric field across any sheath as well as being equally observed from all directions and observed in the no-field regions. The "sheath" explanation is eliminated on all possible parameters.

The line broadening is independent of position, but dependent on time as shown in:

95. R. L. Mills, P. Ray, B. Dhandapani, "Excessive Balmer  $\alpha$  Line Broadening of Water-Vapor Capacitively-Coupled RF Discharge Plasmas" IEEE Transactions on Plasma Science, submitted.

These observations are characteristic of a chemical reaction, and eliminate the "sheath" explanation. Furthermore, broadening is observed in rt-plasma cells that comprise a filament heater only that serves to heat the catalyst

and dissociate molecular hydrogen. There is no strong field as reported in the following papers:

109. R. L. Mills, M. Nansteel, J. He, B. Dhandapani, "Low-Voltage EUV and Visible Light Source Due to Catalysis of Atomic Hydrogen", J. Plasma Physics, submitted.
108. R. L. Mills, J. He, M. Nansteel, B. Dhandapani, "Catalysis of Atomic Hydrogen to New Hydrides as a New Power Source", International Journal of Global Energy Issues (IJGEI), Special Edition in Energy Systems, submitted.
81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physical Journal-Applied Physics, Vol. 28, (2004), pp. 83-104.
54. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.
51. R. Mills, P. Ray, R. M. Mayo, "CW HI Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.
46. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population and a Very Stable Novel Hydride Formed by a Catalytic Reaction of Atomic Hydrogen and Certain Catalysts", Optical Materials, Vol. 27, (2004), pp. 181-186.
42. R. L. Mills, P. Ray, "A Comprehensive Study of Spectra of the Bound-Free Hyperfine Levels of Novel Hydride Ion  $H^{-}(1/2)$ , Hydrogen, Nitrogen, and Air", Int. J. Hydrogen Energy, Vol. 28, No. 8, (2003), pp. 825-871.

## **Section 21**

The Committee further argues on pages 14-15 of its Action:

In the Cvetanovic reference cited in the attached appendix, those of ordinary skill in the art in the plasma field do not agree with the mechanism proposed by the applicant to explain the anomalous broadening in the hydrogen Balmer alpha line (see abstract and pages 033302-1 to 033302-2 of the reference). Instead, the reference states that the excessive Balmer alpha line

broadening is related to the collisions of the fast hydrogen atoms with molecular hydrogen and can be explained by the conventional collision model (CM).

The Committee's misplaced reliance on Cvetanovic et. al. is extremely troubling since this article appears to be a thinly veiled hatchet-job in an attempt to discredit Applicant. Cvetanovic et. al. propose that the energy required to selectively heat atomic hydrogen to extraordinary temperatures comes from the field acceleration of ionic species. The paper **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted** demonstrates that no model of that type is viable. Broadening existed throughout the plasma, and not only in the region of high fields. In fact, it was found that the nature of the broadening does not correlate to field strength whatsoever. All predictions that orientation of the observer relative to the field will impact the nature of the observed broadening were disproved. For example, observation parallel to the field should yield broad lines that are red or blue shifted, and not symmetric, as a function of the orientation of the observer relative to the cathode. The results were always symmetrical. Also, there is every reason to suggest that the magnitude of the broadening observed perpendicular to the direction of the field should be less than that parallel to the field. It was independent of the viewing direction. Phillips et al. provide a data set, remarkably thorough relative to that of previously published work, that shows the shape of the Balmer lines perpendicular to the field, parallel to the field and in regions with no field are remarkably similar under many conditions. This data also makes all forms of the "field acceleration" models of broadening untenable.

The Cvetanovic article contains some data consistent with the statements made above. For example, in Figure 4 of that article there is data that shows that the broadening of the Ha peak is independent of the orientation of observation relative to the field direction.

Unfortunately, although the data agrees with that collected and reported by Phillips et al., the text of the article contains some clear misrepresentations.

Specifically, the data regarding the fit of Figure 4c (but notably not that of Figures 4a and 4b) is missing. It also appears to the careful reader that Fig. 4c was printed in a larger format than Figures 4a and 4b, and hence gives the appearance to the casual reader that the broadening in Figure 4c is larger than that of figures 4a and 4b. In fact, the broadening of Figure 4c is virtually identical to that measured for Figures 4a and 4b.

Perhaps the authors of the aforementioned paper did not want readers to have direct access to the data? Indeed, the data contradicts statements made in the Abstract:

Large excessive Balmer alpha line broadening in pure hydrogen and its dependence upon the direction of observation with respect to the electric field is in contradiction to the resonance transfer model, proposed by Mills et al. in several publications (see, e.g., IEEE Trans. Plasma Sci. 31, 338 2003.)

Putting such a statement in the Abstract is a clear indication of the intent of the authors, i.e. to disprove the RT model despite the data to the contrary. Indeed, since the data they present shows that there is no dependence of line broadening upon the direction of observation with respect to the electric fields, the above statement in the abstract is false. The attack on Applicant's paper thus has the appearance of malice.

The sense of malicious mischief is increased because of additional directly false statements, such as this one from the conclusions:

The presence of large excessive H $\alpha$  line broadening in pure hydrogen and several experimental results, such as the importance of the direction of observation with respect to the electric field and exponential decay of excessive broadened Balmer line intensity in the negative glow, are in contradiction to the resonance transfer model.<sup>5,6</sup>

Not only is the data contained in the paper in direct contradiction to the statement regarding "direction of observation", there is in fact not a shred of data presented that refutes any of the predictions of CQM. It is unfortunate that these statements were even published, but then to be touted by the USPTO is outrageous.



## **Section 22**

The Committee further relies improperly on the Cvetanovic et. al. reference in arguing, on page 15 of the Action, that:

The Cvetanovic reference also states that two independent experiments performed simultaneously in two different laboratories have not been able to reproduce the applicant's excessively broad Balmer line shapes in microwave induced discharge (MIID) experiments (see page 033302-2, left hand column). These laboratories did not detect excessive broadening in the MID experiments. This is contrary to applicant's assertions on page 158 of the present response that the plasma data results have been independently reproduced.

Applicant agrees with the data reported in the Cvetanovic paper that the line energy of the hot H is independent of the direction relative to the electric field, it is symmetrical at all angles and independent of pressure and exists in region of low or no field. The results confirm the catalysis of hydrogen, not field acceleration as the source of the broadened H lines.

It is not clear that Jovicevic et al. failed to observe the phenomenon of fast H in microwave plasmas. In S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004) the authors state that it impossible to form fast H in microwave plasmas since there is no field which the ions can couple to, but at the conclusion they hedge: "In Ar-H<sub>2</sub> discharges, a limited broadening in the wings of the lines coupled be attributed to less than 0.01% fast hydrogen with kinetic energy less than 10 eV". This is very significant given that the electrons heat the atoms and the electron temperature is typically less than 1 eV in these plasmas.

Jovicevic et al used pulsed operation. Others using the same apparatus in continuous operation, as in the case of Applicant's work and following Applicant's direction regarding the dependence on operating conditions and long duration operation, have reproduced Applicant's results:

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002,**  
**[http://www.niac.usra.edu/files/studies/final\\_report/pdf/752Marchese.pdf](http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf).**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated.

See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

42. **R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", J. Plasma Phys., in press.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure ( $\sim 0.2$  Torr) water vapor plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant ( $> 2.5 \text{ \AA}$ ) hydrogen Balmer  $\alpha$  line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is notable that other aspects of the plasma including the  $OH^*$  rotational temperature and low electron concentrations are quite typical of plasmas of this type.

### **Section 23**

The Committee presents further misplaced arguments based on the Cvetanovic et. al. reference, stating on page 15 of the Action:

As pointed out on page 33302-2 of the Cvetanovic reference, applicant's own plasma results contradict his own theory since his plasma data containing pure  $H_2$  only does not show any anomalous line broadening that is inconsistent with his own theory and argument that two hydrogen atoms (that act as a catalyst) can provide a net enthalpy equal to the potential energy of the hydrogen atom (27.2 eV) which is the necessary resonance energy for a third hydrogen atom. As shown in Figures 6, 8, 12, and 14 of applicant's document entitled "Comparison of Excessive Balmer  $\alpha$  Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain

Catalysts" that was submitted to IEEE Transactions on Plasma Science and cited in the information disclosure statement filed on 8/22/2002 in copending case 09/009,837, there is no anomalous line broadening for microwave plasmas of pure hydrogen alone which contradict applicant's own theory and arguments.

Once again, the Committee fails to comprehend that Cvetanovic et al.'s results and Applicant's results support the CQM theory. The following is the exact self explanatory text from Applicant's IEEE paper:

The hydrogen atom energy in plasmas of hydrogen mixed with argon or helium were about 50-100 times that observed for the control plasmas such as hydrogen mixed with xenon or hydrogen alone. Even so, the observed  $\approx 4 \text{ eV}$  energy of the latter plasmas was still well above the resolution capability of the instrument, and surprisingly it was appreciably above that expected based on the electron temperature of 1-2  $\text{eV}$ . The observation of an elevated hydrogen atom energy for pure hydrogen plasmas and mixtures containing hydrogen with the unusual absence of an elevated energy of any other gas present has been observed before. For example, using a GEC RF cell Radovanov et al. [12] observed that the structure of the  $H_\alpha$  line emission from a pure  $H_2$  discharge showed a slow component with an average energy of 0.2  $\text{eV}$  and a broadened component of 8.0  $\text{eV}$ . Very high energies have also been observed. Hydrogen line broadening corresponding to 123  $\text{eV}$  has been observed with hydrogen plasmas maintained in a GEC RF cell [11]. Extraordinary line broadening near the cathode corresponding to fast H with  $>300 \text{ eV}$  has only been observed in the case of discharges of hydrogen or in hydrogen mixtures. This phenomenon is not observed in discharges of pure noble gases [8, 11, 29-32]. In the case of production of fast H, the intensity may be low due to efficient collisional energy exchange with dissociative excitation of molecular hydrogen [33]. In a glow discharge fast H is formed and excited predominantly near the electrode surfaces. The emission from fast H formed at the cathode is also not expected to extend significantly into the bulk of an  $H_2$  discharge because of quenching of  $H(n=3)$  by collisions with  $H_2$  [12]. Again, this unusual effect was attributed to electric field acceleration of positive hydrogen ions in the cathode fall region.

In our microwave hydrogen plasma, no such strong field exists. But, the conditions for an rt-plasmas are met. Since the ionization energy of hydrogen is 13.6  $\text{eV}$ , two hydrogen atoms can provide a net enthalpy equal to the potential energy of the hydrogen atom, 27.2  $\text{eV}$ —the necessary resonance energy, for a third

hydrogen atom. On this basis, the unusual observation of the H energy slightly above the electron temperature is expected. The effect is expected to be more pronounced at higher greater hydrogen concentrations such as those produced near or on the cathode in RF and glow discharge cells.

#### **Section 24**

Finally, the Committee argues on pages 15-16 of the Action:

Thus, in view of the serious flaws in applicant's theoretical foundation for his invention, the lack of independent, reproducible experiments to verify the existence of the hydrino atom, and the lack of conventional acceptance of the existence of the hydrino atom which is contrary to the accepted scientific theory of the hydrogen atom, applicant has failed to provide preponderance of evidence to support his claims.

The scientific evidence presented by Applicant, as well as his detractors, supports Applicant's theory in refutation of the erroneous position taken by the Committee. The data clearly indicate that the selective extraordinary H broadening in only those plasmas that contain hydrogen and a suitable catalyst can not be explained by field acceleration, but are absolutely consistent with the predictions of CQM and the formation of hydrinos.

The Committee has refused to properly consider this compelling scientific evidence based on its adoption of the biased views espoused by Examiner Souw in his Appendix. Applicant appeals once again to the Committee to reconsider its tenuous position and to allow the present application to issue.

**BEST AVAILABLE COPY**